



LAB NEWS

VOL. 38, NO. 17 SANDIA NATIONAL LABORATORIES AUGUST 29, 1986

IT ALMOST ESCAPED the film frame, but not before the camera caught shock waves created by Sandia's Mach 2 parachute system shortly after launch during a test at Tonopah Test Range. The Honest John booster (dark section at rear of vehicle) is

still boosting, it's plain to see. At this point, the vehicle is traveling between Mach 2 and 3, but after Honest John drops away, it'll "slow down" to the Mach 2 deployment speed. (More pix on Page Six.)

Aw(e), Chute

Labs' Parachute Designers Working on Two New Projects

The engineers in Parachute Systems Division 1632 are currently working on a couple of Sandia "firsts." One is a redesign of the F111 aircraft crew module recovery parachute; the other is design and development of a parachute system that can withstand deployment at velocities as high as Mach 2 (twice the speed of sound — which is about 1100 feet per second [fps] at sea level).

Phase I proof-of-design air drop tests began last December at Tonopah Test Range on a single unit of what may become a three-parachute cluster for the crew escape module (CEM) of the F111 aircraft. It's the first Sandia parachute system designed specifically for manned use, with the objectives of saving lives and preventing serious injuries.

The F111 — used as a fighter bomber or for reconnaissance — is a high-performance aircraft no longer in production, explains Don Johnson (DMTS, 1632), project leader for the new parachute system. "But it [the F111] will be in use beyond the year 2000," says Don. "Its recovery system is advanced, complex, and sophisticated."

Adding More Drag

"The Air Force asked Sandia to look into the possibility of making the escape system safer by increasing the system's drag — lowering the impact speed from over 30 feet per second to about 25 fps," Don continues. "Our design has to dovetail into the space and volume of the present system and be retrofitted into existing aircraft."

The F111 system is the first ejectable CEM to be used in an aircraft. In an emergency, the entire pressurized, 3250-lb. (including pilots) two-person module — the cockpit of the plane — is explosively separated from the rest of the aircraft. A solid-propellant rocket motor fires, a stabilizing parachute deploys, and at a velocity of 300 knots (345 mph) or less, a 70-ft.-diameter ring sail parachute is catapulted from the module to slow it to landing speed. As the module approaches the earth's surface, an airbag beneath the module is inflated (in a water landing, additional flotation bags are inflated.) The airbag helps cushion the module's impact.

Module recovery must also be possible in the case of ejection from a stationary aircraft sitting on the ground. In that case the rocket motor propels the CEM 400 to 500 ft. up, and the deployment sequence begins.

The crew module as originally designed weighed less than 2800 lbs. But new cockpit electronics have increased the weight to 3250 lbs. and caused an increase in impact velocity. Lowering the impact

velocity of the CEM will reduce the risk of injury to the crew.

"Our job is to lower the impact velocity by adding more drag to the parachute system," Don says. "The new requirement — 25 fps impact speed — requires that the drag area of the system be nearly double that produced by the existing 70-ft.-diameter

(Continued on Page Six)

An Unofficial 'Center of Excellence'

Chutes for Nukes — and More

Parachute work seems a bit off the beaten path, in terms of Sandia's overall mission. Why are we in the business?

"We're directed through an agreement between the DOE and the Air Force to design parachutes for nuclear weapons; that's the reason the capability is here," says Carl Peterson, supervisor of Parachute Systems Division 1632.

Parachute R&D was started at Sandia in 1953 to study the feasibility of laying down a nuclear bomb from an aircraft flying at low altitudes at transonic speeds — 95 percent to 110 percent of the speed of sound. Between 1957 and 1975, the Air Force and Sandia jointly designed parachutes for the B28, B43, B53, B57, and B61 laydown bombs. In 1975 DOE/Sandia assumed sole responsibility for the design of all nuclear weapon parachutes; the 24-ft.-diameter parachute for the B61-3,4 and the 46-ft.-diameter parachute for the B83 were designed by Div. 1632.

Sandia has pioneered the use of Kevlar, which has more than twice the strength-to-weight ratio of nylon, to optimize the drag efficiency of heavy-duty parachutes — the B83 chute can withstand an opening shock (drag load) of 210,000 lbs.

And Sandia has developed codes that are not available anywhere else to predict parachute inflation, deceleration forces, bomb/parachute trajectories, and stresses in parachute canopy materials.

In addition to their use in delivery systems,

these parachute technologies have also been applied to designs of recovery systems for the W79 and W82 nuclear shells, recovery of Sandia sounding rocket payloads (150 flights), and recovery of reentry vehicles (Mk21 nosetip, for example).

And these same parachute technologies have made Sandia the unofficial "Center of Excellence" in parachute technology in the Free World. When Sandia hosted (jointly with the Univ. of Minnesota) a short course at the Technology Transfer Center last year to disseminate parachute technology, more than 100 engineers attended (LAB NEWS, Sept. 13, 1985).

"Because the parachute experience is here, and the capability is unique, we can take on other kinds of parachute work that others simply can't do," says Carl. "Outsiders — government agencies, mainly — come to us for design support. For instance, we furnish parachute recovery systems for all of NASA's rocket-launched scientific payloads. On occasion we do work for other countries. For example, through NASA, we've worked on recovery systems for international scientific payloads."

Other current reimbursable projects are: 1) consultants for NASA on the Space Shuttle Solid Rocket Booster recovery system; 2) air-delivered cargo systems for the U.S. Army; and 3) an improved F111 Crew Escape Module Parachute System for the USAF (see main story).

On Sailing to San Diego By Friday

John Liebenberg (8132) doesn't believe Friday the 13th is unlucky. So, because the hull number on his 27-foot Express sailboat was 13, he named it Friday.

His luck held: This summer he captured second place in the Midget Ocean Racing Association (MORA) long-distance offshore race between San Francisco and San Diego.

At sea for 76 hours, John and his three-man crew navigated their way south, using "four hours on and four off" shifts for work and rest as they covered the 437.5 nautical miles.

Because the event is open to all entrants with boats 31 feet long or less, judging was on a handicap system. John made San Diego two hours behind the first-to-finish boat (which was sailed by another Livermore man, Dick Heckman of LLNL). But, on a corrected time basis, Friday came in second, only seven minutes behind the winner after 76 hours at sea. (Corrected times put Dick's boat in fourth place.)

Along with his sailing skills, John and his crew used the technical assistance of a Loran-C navigation system to determine their position in the race every few hours. That was helpful: "In this race we chose to keep 20 to 40 miles offshore where the winds are heavier," says John. "And we managed to skirt all the channel islands off the Southern California coast in favor of open sea and better breezes.

"Then too, the boat is light enough that it can catch the crest of a wave and 'surf' for a while — enough to increase our speed from the normal 6-to-8 knots up to 15.

"The first 24 hours out were not as frightening and physically exhausting as we expected, given the choppy northern waters between Point Sur and Point Conception," John continues. "With the wind under 20 knots and a very clear sky, we could actually enjoy the stars and an outstanding meteorite show — until the moon rose at 3 a.m.

"For a half hour during the second day out, we were entertained by a school of dolphins playing around us. And we met a large whale — variety unknown — heading north at the surface. He was only about two boatlengths off our starboard side."

The crew's only communications link was a VHF marine radio that is good for line-of-sight transmissions. They also carried the required eight-day food-and-water supply in the event boat trouble or lack of wind forced them to survive the open ocean for a longer period than the normal race time.

Beyond Boy Scout Sailing

John was introduced to sailing when he took a job as waterfront director at a Boy Scout summer camp at Huntington Lake near Fresno in 1960. Then he took a sailing course while at UC Berkeley and really "got hooked" on the sport. His first boat was a 14-foot Lido for lake sailing, followed by a 24-foot Islander Bahama for racing in the Bay.

He sailed in the Fireball class 16-foot size for more than 10 years, but in 1981 got his 27-foot Friday, which is good for both Bay and ocean racing. Each year from April through September he spends three out of every four weekends on the water, berthing his boat on a trailer at the Richmond Yacht Club.

John's crew for the San Diego race included a San Francisco State student and two longtime sailing friends, Scott Owens and Jim Antrim. Jim is a naval architect who has sailed with John for about five years off and on; Scott is a 12-year fellow sailor. (Although not in the San Diego race, two Sandians have been crewing regularly with John as well — Carl Melius, 8343, for 10 years, and Linda Barncord, 8235, the past two.)

The San Diego race was not John's longest — he's taken part in two Trans Pac events from the Cal-



SHOWN AT FULL SAIL are John Liebenberg (8132) and crew aboard his "lucky" 27-foot sailboat, Friday enjoying favorable winds. Boat and crew took second in recent San Francisco-to-San Diego race.



SANDIANS on the sailboat during a recent Bay outing are (from left) John, Carl Melius (8343), and Linda Barncord (8235).

ifornia coast to Hawaii, an endurance run of 2200 nautical miles. And he's competed in other races from LA to Mazatlan and to Cabo San Lucas. He won the Express 27 one-design season championship for the SF Bay in 1984, and he was overall winner of the MORA ocean series (10 individual races) in 1985. Second place last month was his best finish in the San Diego race in three tries.

Maybe he'd have taken first in a boat named Thursday.



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TAKING PART in a brief "topping off" ceremony outside Sandia's Weapons Engineering Lab (Bldg. 910) recently were DOE Deputy Secretary William Martin (right) and Vice-President Dick Claassen (8000). The Deputy Secretary was making his first visit to Sandia Livermore since assuming his new position earlier this summer. He told about 100 Sandians gathered at the construction site that this building "represents many of the things we are trying to accomplish in national security as far as weapons engineering and development and in electronics and physics. . . . The labs inside will also be devoted to applied research in the weapons program and contribute to the Strategic Defense research program." Construction completion is expected in the fall of 1987 with occupancy planned for February 1988.



ANNUAL YOT SHOT shows most of this year's crop of 86 Youth Opportunity Trainees. Students are selected for the program based on scholastic performance, school attendance, teacher recommendations, and economic need. They spend the sum-

mer at Sandia in a variety of technical and non-technical organizations. Soila Brewer (3533) coordinates the program.

Take Note

The New Mexico Chapter of the American Vacuum Society will offer three short courses in vacuum science and technology at the Amberley Suite Hotel (7620 Pan American Hwy. NE) on October 14-17. Courses include: Basic Vacuum Technology, Computer Operations for Vacuum Equipment Control, and Vacuum Safety. William Rogers (1134) and Warren Taylor (ret.) are two of the instructors for the course on basic vacuum technology. Registration is on a first-accepted, first-served basis. Registration forms are available in the LAB NEWS office (Bldg. 814). For further information, contact Frank Williams on 277-5431.

A paper, "Si-29 NMR (Nuclear Magnetic Resonance) Study of Plasma-Polymerized Hexamethyldisiloxane" by Roger Assink (1812), Kay Hays (1831), Dick Bild (1821), and Bruce Hawkins (Colo. State Univ. NMR Center), has been selected to receive the Bunshah Award presented by the Vacuum-Metallurgy Div. of the American Vacuum Society. The paper was presented at the Emerging Technology Symposium of the International Conference on Metallurgical Coatings (ICMC) in Los Angeles in April 1985.

Jennie Negin (3411) was recently selected to participate in the Leadership Albuquerque program sponsored by the Greater Albuquerque Chamber of Commerce. Leadership Albuquerque identifies, trains, and directs emerging community leaders and is structured to benefit the participants, their companies, and the community. Jennie is one of 35 applicants, representing a variety of backgrounds and interests, chosen to participate from a group of 94. Objectives of the program are to expose emerging leaders to the opportunities and challenges within the community, to introduce them to present leaders, to build understanding of the leadership role, and to encourage them to take active roles in the community. Three program committees took part in choosing the participants: the recruitment, screening, and selection committees. Lee Bray (30) is a member of the selection committee.

Bob Martinez (5217) helped out the International Atomic Energy Agency last Memorial Day weekend by setting up and manning the IAEA booth on safeguards activity at the Annual Convention of the American Association for the Advancement of Science in Philadelphia. Bob was the technical consultant on IAEA's exhibit on Ministar and the fiber optic (cobra) seal, projects Sandia helped develop.

Arlene Schaefer (122), newly-elected NAA New Mexico Chapter President for 1986-87, heads a slate of 22 officers to direct the activities of the state chapter of the National Association of Accountants for 1986-87. The board of the Albuquerque Chapter

includes Shanna Cernosek (142), VP of Communications & Public Relations, and Ilene Mathes (4021), Meeting Director.

Both Presidential Scholars from New Mexico this year are children of Sandians. Suzanne Chambers (daughter of Bill, 1822) and David Lawrence (son of Jeff, 332) were among the 141 American students recognized for their scholastic and artistic achievement at a five-day program in Washington, D.C., in June. Suzanne and David are '86 graduates of Manzano High School.

Living with cancer is not easy for patients, for families and friends, or for medical professionals. The Albuquerque Cancer Support Coalition is offering a conference, "Breaking the Silence: People, Cancer, and Emotions," for people who are living with the effects of cancer. The conference will help those people share information and feelings during discussion groups and presentations.

The day-long workshop will be held on Sept. 6 from 8:30 a.m. to 3:30 p.m. at the First Baptist Church (Central and Broadway). There is no admission charge for the general public; box lunches are available for \$4.50 for pre-registrants. A nominal charge for continuing education credits for professionals includes lunch. Babysitting is available for \$4.50 per hour. For more information, to register for the workshop, and to reserve babysitting services and lunch, call the American Cancer Society at 262-2333.

Got some extra household furniture? time? money? You could give the new Youth Development Center (a United Way agency) a big hand. A new facility will be opened Jan. 1 in Albuquerque at the former Girl's Welfare Home behind the Motor Vehicle Dept. The facility will provide diagnostic services, family counseling, and out-patient treatment for children between 10 and 15 yrs. old who repeatedly run away from their present homes. The facility and services will be partially funded by the government, but more help is needed from the private sector. Donations of money, furnishings, and time are essential to the success of the facility's first year of operation. To find out more about the facility and how you can help, contact Chris Baca on 873-1604 or Patricia Baca (3432) on 6-3880.

Sanado Woman's Club has selected new officers for the year: Sally Cleland, president; Mariane Miller, first vice-president; Helyn Jackson, second vice-president; Kathy Irwin, third vice-president; Norma Goodwin, fourth vice-president; Yolanda Schindwolf, fifth vice-president; Barbara Bess, secretary; and Marie Waibel, treasurer. Sanado's basic purpose is to establish friendships among wives of Sandia/DOE employees. A membership party is scheduled for Sept. 9 at 10 a.m. at the home of Vicky Hardin,

407 Live Oak Loop NE. There will be food and door prizes. If you are interested in visiting or joining Sanado, please make a reservation by Sept. 5 by calling Marsha Cook on 296-3064.

Local Air Force history buff Clayton Harris (husband of Dollie, ret.) wants other AF alumni to know about some reunions and information exchanges. The 12th reunion of WWII's 452nd Bomb Group Assn. is set for Sept. 11-14; a reunion of the 461st Bomb Group, part of the 15th Air Force that flew B-24s in Italy, is also upcoming if enough former members respond. A new association of 15th Air Force veterans is forming. And a retired lieutenant colonel needs information for a book on the Martin B-26 Marauders' role in WWII. Call Clayton on 255-6577 after Sept. 3 for contacts on any of these.

Interested in learning Chinese? The Chinese Language School is offering different level classes starting Sept. 7 at UNM. The classes will run 13 weeks on Sundays from 2-4 p.m. Cost for each class is \$30. Registration is at UNM, Ortega Hall, Rm. 215 on Sept. 7 at 1:30 p.m. For more information, call Margaret Chu at 293-4375 or Regina Chen at 298-6477.

Did you know New Mexico has 185 state-listed and 25 federally listed endangered species (of both flora and fauna)? To find out more about about them, attend the 2nd Annual Endangered Species Fair Sept. 6 at the New Mexico Museum of Natural History. Activities include speakers, films, exhibits, live animals, musicians, food, and a wildlife art sale. Special guest will be Steve Martin with his free-flying bird show. Admission is free. The hours are from 10 a.m.-6 p.m. for indoor presentations and 6-8 p.m. for outdoor entertainment. The fair is sponsored by NM Museum of Natural History, NM State Game and Fish Dept., Rio Grande Zoo, and Sierra Club Wildlife Committee. Funding is provided through the "Share with Wildlife" program of the NM State Game and Fish Dept.

Now there's touchable art. An exhibition by Paul Ré, "Touchable Art: An Exhibition for the Blind and Sighted," opened Aug. 24 at The Albuquerque Museum. The exhibit consists of 21 embossed plastic plates with compositions of various shapes, generally of a closed circle. Some are simple, some are intricate configurations, and are arranged so that the figures progress from simple to complex and back to simple. Along with the embossed plates are photographs of the original drawings and paintings from which the plates have been taken. Ré is also a physicist whose work with structures and mathematics has influenced his choice of shapes and the interrelationships of space and form. The exhibit will hang until Oct. 12.

Welcome

Albuquerque

Nancy Turner (2543)

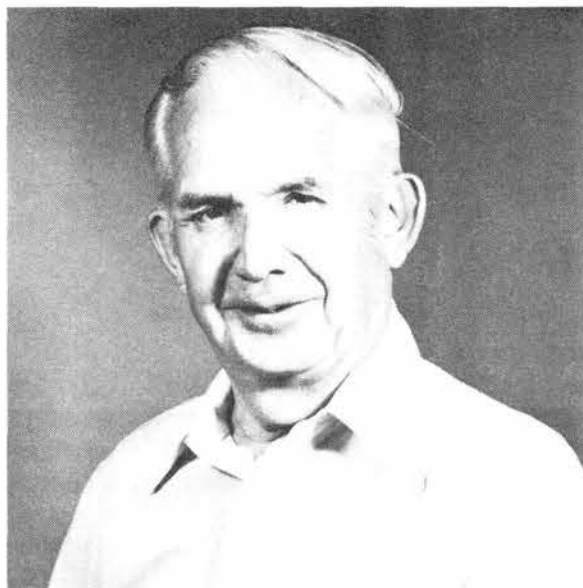
Mississippi

Cullen Lee (1625)

New Mexico

Otha Caddy (7811)

Retiring



Blythe Wemple (7472)

40 yrs.



Floyd Coppage (5160)

28 yrs.



"YOU'VE MADE THE BOMB YOUR GOD," thunders The Priest in Lanford Wilson's 1983 play *Angels Fall*, which will open Sept. 5 and run for three weekends at the historic Corrales Adobe Theatre. A former church, the theatre is the proper setting for the play, which is set in a mission church on the Navajo Reservation in northwestern New Mexico. The mission priest is played by Bill Carstens (who retired from Sandia in 1978): "It's a little like *Bus Stop* in that the other five characters are trapped in my church by a little 'incident' at the uranium mine up the road. Good show — strong, provocative stuff." Christie Mendoza directs. Curtain's at 8:30; reservations at 898-3323.



HISTORIC CHIP passes from Dale Clements (center), manager of the three-year-old Bendix Albuquerque Operation, to Dan Hardin, manager of Trident II Warhead Development Department 5150. The integrated circuit, used on the integrating accelerometer in the Trident II system, is from the first lot of ICs that were fabricated, packaged, and tested entirely by Bendix, and thus marks a milestone in the gradual transfer of IC production work from Microelectronics 2100 to that agency. The transfer is allowing 2100 to concentrate on chip design and development work, rather than production. Also present for the ceremony were (from left) Lou Smith, who was Asst. General Manager of Bendix Kansas City (and Dale's boss) during the Trident II chip production period (he's now VP of Production Operations for the Aerospace Sector of Allied Signal Corp., Bendix's parent company); John Morrison, the new Asst. General Manager of BKC; and Larry Anderson, VP Component Development 2000, who represented Bob Gregory, director of Microelectronics 2100, and his organization.



BUSINESS LAW is the subject of the second CPS (certified professional secretary) review course; it's taught by Robin Cassell (1810), and it begins Sept. 8. The first course, Behavioral Science in Business, taught by Linda Caudell (21-1) and Sue Henderson (3700), ended recently, and the third one, Accounting, taught by Etta Moore (3452) will bloom in the spring. If you're interested in earning the CPS rating someday, contact any of the current holders, some of whom are shown above: (standing, from left) Julia Norwood (3400), Esther Coffman (1820), Rae Botner (3726), Robin Cassell, Irene Myers (7213), Etta Moore; (sitting) D'Ann Anderson (5200), Wanda Whitham (6400), Estelle MacKenzie (5210), Roselyn Baca (6332), Sue Henderson, Phyllis Pryor (3723), Ruth Tucker (6222), Linda Caudell, and Jeana Pineau (5114). Not shown: June Aydelotte (3543), Claire Ford (3521), Lillian Podvin (5313), Bobbi Voelker (3151), Cathy Wilson (1252), and Jerri Dye (120).



In this issue we are featuring a couple of current volunteer opportunities for retirees and family members. If you would like more information, call Karen Shane (844-3268).

RIO GRANDE ZOO is recruiting volunteers for its fall training session for docents. Introductory coffee will be offered on Wednesday, Sept. 3, at 10 a.m.

NEW MEXICO CHAPTER, NATIONAL COMMITTEE ON YOUTH SUICIDE PREVENTION is seeking volunteers for several assignments, including clerical, public relations committee, speakers' bureau (to talk to civic groups), and school programs.

Congratulations

To Laurie Monette and Robert Caldwell (1141), married in Michigan, July 26.

To Carol Henry (6422) and Donald Stillman, married in San Diego, Aug. 2.

To Lynn Gundie and Ken Ward (1823), married in Seattle, Aug. 10.

To Diane Szepesi (2851) and Douglas Trump (7533), married in Albuquerque, Aug. 17.

Sympathy

To Len Wilhelmi (5251) on the death of his mother in Conchas Aug. 4.

Home Sweet . . . Office



Professionals who put in grueling hours on the job often say that the office feels like a "home away from home." Now psychologists are saying that for many of us the office *is* our home. . . . "For many people, office friendships are the best ones they have," writes Jacqueline Plumez in *Divorcing a Corporation*. "Water coolers and coffee machines have become the gathering places that back fences used to be."

Science Digest



Continued from Page One

Designer Parachutes

parachute. Each of the three parachutes in the new system is designed to develop a maximum of 8000 lbs. of drag force [deceleration load].

"We ruled out the use of a large single parachute to meet the new specs," continues Don. "That's because inflation time would be too long and a cluster system provides more drag during the parachute inflation." Theoretical analysis of the concept of apparent mass of a decelerating parachute/payload system indicated a three-parachute system (with the same steady-state drag area as a larger single parachute) will provide more drag during parachute inflation than the single canopy.

This theory was proven by comparing the results of Tonopah aircraft drop tests of a B83 test vehicle equipped either with a 46-ft-diameter parachute or three 25-ft-diameter parachutes. "That's why we proposed the three-parachute cluster," Don says.

Each chute, with a diameter of 52.5 ft., weighs only 30 lbs. Each has eight rings in the vent area (that is, eight horizontal rings, or bands, in the top part of the parachute, with slots in between to allow air to escape) above a solid canopy. Trajectory codes and the canopy structural analysis code CANO were used to optimize the design of the parachute system.

The parachutes are hybrids; they're made of a Kevlar/nylon combination, resulting in less bulk than the original system — a good thing, since space allowed for the system in the F111 module is a cramped, odd-angled compartment containing about 3.3 cubic ft. of space. (Kevlar — with 2.7 times the strength-to-weight ratio of nylon and not as bulky — was unavailable when the original system was designed in the '60s.)

"Chute-packing specialists in Sandia's parachute lab are currently working on ways to pack the three-cluster design," Don says. "We weren't even sure it could be done until Ken Ronquillo and Richard Brazfield [both 1632; see "High-Caliber Crew" story] completed the first prototype package in early August.

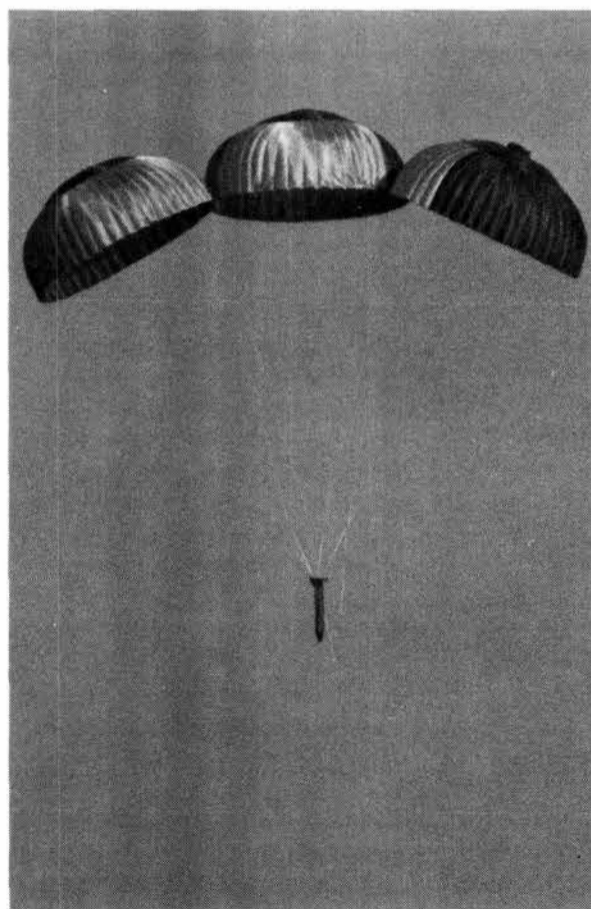
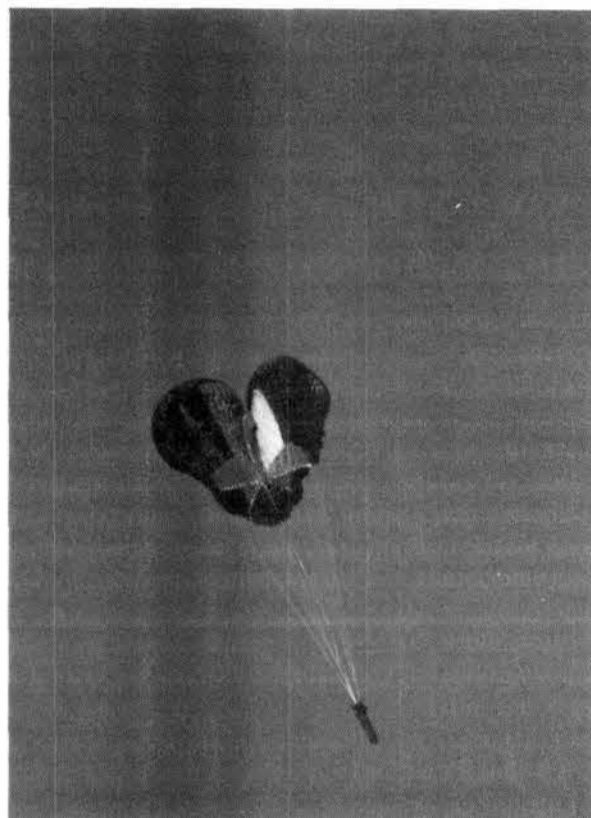
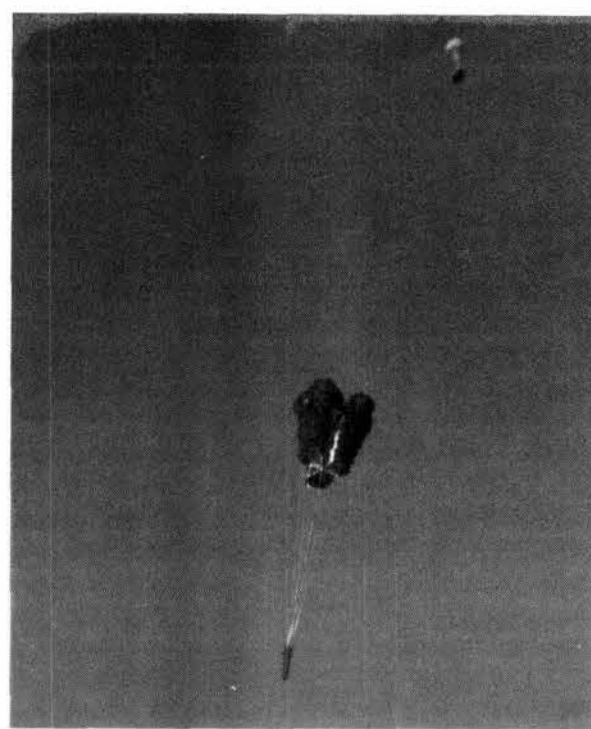
"So far our proof-of-design air drops at Tonopah have yielded very positive results," says Don. "The system is performing as expected. We first ran three drop tests to characterize a single chute carrying a test vehicle weighing one-third of the actual weight of the crew module. Three more recent tests using all three parachutes with a 3300-lb. test vehicle yielded equally encouraging results."

Twenty Phase II development air drop tests at Tonopah, beginning next January and continuing until mid-summer 1988, will use a test vehicle more representative of an actual F111 crew module. The test aircraft will be the NASA-modified B52. One devel-



IN PHOTO ABOVE, Ken Ronquillo (top) and Richard Brazfield fit the F111 chute cluster into the plane's crew escape module. It's the first Sandia chute system designed for manned use.

IN LEFT PHOTO, Ken Ronquillo of the Parachute Lab demonstrates the size of the F111 chute cluster — and of the problem: Each of the three chutes is 25 feet long; the suspension lines are 60 feet long, and there are 48 lines per parachute; and everything has to fit into the bag Ken is contemplating. When it's packed, the bag has nearly the density of an oak log.



WHAT? YOU CAN'T SEE the suspension lines? That's understandable, because they're 1/8-in. wide — a little bit larger than the lead in your #2 pencil. They are there, though, suspending a test payload from the three-cluster parachute system designed for recovery of the F111 crew module. Photo series was taken during an air-drop test at Tonopah Test Range earlier this year.

opment ejection test using an actual crew module is scheduled for September 1987 on Holloman AFB's sled track.

Tests to qualify — and to demonstrate the reliability of — the new system begin in June 1988. In all, 22 consecutive successful tests (14 air drops and 8 crew module ejection tests) are required during Phase II for qualification and reliability purposes.

Jerry Adams (2857) developed the CAD (computer-aided design) program for the F111 parachute system — the first time that the detailed design of such a system has been done on a computer. Don Moore (2857) did the CAD work on the F111 compartment shape in which the system must fit. Jim Gallagher and Johnny Ruybal (both 1653) were responsible for the parachute test vehicles, and Barney Barnett (5143) provided the telemetry package.

The Other First

The other first, a Mach 2 parachute system, was designed and developed to recover an 800-lb. test payload flying at either supersonic or subsonic speeds. It's the first supersonic parachute system designed to be qualified for weapon programs. (Other chute systems used for supersonic deployment are used for test purposes only.)

"Deploying a chute in a Mach 2 environment presents some difficult design problems," says Don Waye (1632), project leader for the system. First, the Mach 2 parachute canopy is subjected to a parachute opening dynamic pressure loading of 4400 lbs/ft², which is approximately twice the dynamic pressure loading of any nuclear bomb parachute previously designed and currently in stockpile. This loading requires a very heavy-duty ribbon parachute and careful attention both to the calculation of canopy aerodynamic loading during inflation and to the stresses in ribbons and shroud lines.

Second, parachutes at supersonic speeds tend to "squid" — the normal shock waves in front of the canopy change the pressure distribution around the parachute such that the skirt of the chute moves in and out, resulting in a parachute only 75-percent inflated and in a supersonic drag that's only about 50 percent of the drag at subsonic speeds.

Third, the parachute is immersed in the turbulent supersonic/subsonic wake of the test body, which causes parachute/bomb instability (the parachute oscillates in and out of the wake depending on the length of the shroud lines).

And fourth, the turbulent supersonic wake flow

(Continued on Next Page)



TOP PHOTO shows Honest John rocket ready to launch test payload from Tonopah Test Range. Payload carries a 5-foot (diameter) parachute that can survive deployment at Mach 2 (twice the speed of sound); see photo on Page One. Bottom photo shows payload after impact; obviously, the chute survived.

Mach 2 Chute

causes flutter of the parachute ribbons resulting in potential ribbon failure.

Tests of 15-in.-diameter parachutes (hemisflo — top shaped like a hemisphere — and conical ribbon) were conducted in the NASA Lewis 10 ft. x 10 ft. test section wind tunnel at Mach 2, 2.3, and 2.6 to systematically study all of these effects before doing the chute design. The parachute inflation code "INFLAT," the flight mechanics code "BODY," and the canopy structural analysis code "CANO" were used to design (and redesign) the Mach 2 parachute. In addition, Don developed a new interactive design code for this program. The code determines pattern length, vent diameter, radial lines length, horizontal ribbon length, and geometric local and average porosity.

"We've conducted 18 full-scale flight tests at Tonopah at deployment speeds up to Mach 2.15, or 2300 fps," says Don. The parachute test vehicle is boosted up to supersonic speeds by an Honest John rocket motor; the booster is then separated before parachute deployment. Several parachute configurations were used in the full-scale tests, which began in December 1984. Performance data were used to define an acceptable parachute system, and to gain insight into which design parameters are most critical for supersonic parachute design. Based on the flight test data, a 21-ribbon conical ribbon parachute was the optimum design.

Considering payload weight and deployment loads, the parachute is amazingly small — slightly more than 5 ft. in diameter. And it takes up very little space when it's packed before deployment: the finished pack diameter is 4-1/2 in. and the deployment bag length is just 34 in. The entire pack weighs

11.2 lbs. — which is rather small, considering that the system applies maximum deceleration loads of almost 50,000 lbs. to the payload when it's deployed above Mach 2.

"The conical parachute, with its cone-shaped canopy, performed better over the complete range of Mach number deployment speeds required — subsonic to supersonic — than two other configurations tested," continues Don. "A hemisflo chute inflated well and was stable at supersonic speeds, but it tended to collapse when the system decelerated to subsonic speeds. The opposite was true for a biconic [two-angled canopy] design."

Based on wind tunnel tests and analysis, several changes were made to the chute design to improve performance. Originally, the conical ribbon parachute, equipped with 5-ft.-long suspension lines, showed significant drag losses at supersonic speeds. In parachute jargon, "squidding" caused the problem. Underinflation severely diminished the chute's ability to "put on the brakes."

Ribbon Flutter Damage

"Not only that — we experienced some flutter damage to the skirt ribbons that were uninflated as a result of squidding," reports Don. "Then the chute would oscillate around the forebody wake when the vehicle decelerated to subsonic speeds." (Ribbon flutter damage is much like that to a flag when it's whipped around in a stiff wind; it frays. With the parachute, the ribbons are ripped apart.)

"We made a couple of design changes to correct these problems," continues Don. "We installed 9-ft.-long suspension lines that put the parachute farther behind the payload's turbulent wake; the wind tunnel test data and wake studies indicated this was a better location. There was no more squidding, and the chute inflated at all supersonic speeds from then on. And after we narrowed the ribbon width to half the original size, we saw no more flutter damage. Parachute stability was excellent at both supersonic and subsonic velocities."

At supersonic speeds, parachute deployment must be carefully controlled to avoid catastrophic damage to the parachute during the deployment and inflation process. "We chose a tractor rocket [called that because it pulls something else] to do the job," says Don. "Its performance is independent of deployment speed. It always has the same thrust, and pulls out the deployment bag at exactly the same speed every time."

The tractor rocket (which moves in the opposite direction of the payload) fires to initiate deployment and pulls the aft section of the payload away, stripping the deployment bag from the parachute. "It's necessary to keep the acceleration of the aft payload section constant while the suspension lines and canopy are deployed," says Don. "That meant we had to intentionally decrease the tractor rocket's initial ignition thrust of 4400 lbs. during deployment. Larry Rollstin [1635] had the job of calculating what kind of thrust decreases were needed to maintain constant acceleration."

The new parachute system is strictly a deceleration device; it stays with the payload only four seconds after it's inflated, then is cut away as the vehicle free-falls to earth.

The system might be used for conventional weapon payloads, as well as for any of several nuclear weapon applications, Don told us. "The important thing is that a capability now exists that didn't before," he says. "We know how to slow something that's traveling at Mach 2 speeds, and we can use the knowledge we've gained for other programs."

Larry Whinery (1632) was responsible for detailed design work and packing procedures. Dave Preston (1653) worked on design and assembly of the parachute test vehicle, and Jim Trentham (5143) was responsible for the telemetry system. ●PW

Parachute Lab's Unique

A Creative, High-Caliber Crew Gets It Right the First Time

Capabilities of Sandia's parachute lab (Div. 1632) are well-known around the country. It's the only truly advanced development lab in the U.S. dedicated solely to the task of developing new parachute systems and parachute-packing procedures.

So what does the parachute lab staff do? Just about everything that chute work entails, according to division supervisor Carl Peterson: packing, rigging, prototype deployment bag fabrication, and evaluation of new material. "On occasion, they build prototype and model chutes as well — for example, the Mach 2 system [see main story] and scaled wind model parachutes," says Carl. "And yes — we even have a few sewing machines!" The small number of people "just boggles the mind of outsiders," comments Carl. "Most are sure we must have a cast of thousands turning out the work."

"Sometimes we're asked to do unbelievable stuff," continues Carl, "and these guys get the job done. I never cease to be amazed at their versatility. No question about it," he adds. "these folks are without a doubt one of the most creative, high-caliber crews I've ever been around."

The key to the successful, repeatable, and reliable deployment of a heavy-duty parachute at high dynamic pressures (at transonic or supersonic speeds) is the design and fabrication of the deployment bag. The bag is made of nylon or Kevlar with Teflon liner to reduce the friction as the chute is ripped from the bag.

Canopy and shroud line "break tie" loops are installed in the bag to provide orderly lines

first and then canopy deployment during the approximately 0.5-second bag strip time. The shroud lines and canopy must be deployed in a uniform, orderly linear sequence (with no canopy fishhooking) or the canopy will fail because it won't inflate symmetrically.

The six people on the lab staff have a total of 70 years of experience in the fabrication of these deployment bags and prototype parachutes. The best indicator of their capabilities is that the prototype parachutes and deployment systems usually work the first time.

Parachute packing techniques are developed by the lab staff for all weapon parachutes. The group then prepares packing handbooks ("Tech Orders") and trains members of the Air Force in how to pack parachutes for War Reserve weapons.

Pressure packing (using hydraulic presses) is required because of the limited volume available in a nuclear bomb for the parachute pack. An example is the B83 pack. "Try compressing a 200 lb., 46-ft.-diameter, 70-ft.-long parachute — with all the reefing and suspension lines — into a pack 16.5 in. in diameter and 42 in. long," says Carl. "Impossible, you say? That's what happens when the B83 system is packed. In final form, the solid pack has nearly the density of an oak log — about 40 lbs. per cubic foot." This parachute pack is designed to stay in stockpile for 20 years and then operate reliably at transonic or supersonic speeds after this shelf life.

The laboratory staff: Ted Botner, Hal Widows, Ken Ronquillo, Larry Whinery, Richard Brazfield, and Horace Lucero. Nice going, guys!



WORKHORSE OF RADIATION THERAPY at UNM's Cancer Center is a linear accelerator that electronically produces 6 million electron volts. It's one of three machines — including a Cobalt-60 — that can be rotated in all directions for treating malignant diseases such as cancer, lymphoma, and leukemia. For localized treatment, the patient wears a mask with a cutout exposing the site to be irradiated. The alternative treatment is usually chemotherapy.

United Way Aids a Sandian

A Helping Hand at the Driver's Wheel

She's an MTS whose husband was diagnosed as having a brain lesion six years ago. He had been stalwart about his symptoms, mainly epileptic seizures. He decided to wait and see before starting treatment.

Then, after a few years, the seizures got worse. He switched doctors and found out after a CAT scan at St. Joseph's Hospital that the lesion had grown.

He underwent surgery last October, when a biopsy (a slice of tissue cut out for examination under a microscope) showed that the growth was malignant. As happens with brain cancer, there was no way of knowing for sure whether all the multiplying cells had been removed.

Radiation therapy was scheduled next, for six weeks. The procedure involved going to and from the hospital each morning, a trip that lasted two to three hours. There was not much she could do for her husband at the time without jeopardizing her job at Sandia. The travel problem sounds small, but it

was significant enough — if left unsolved — to throw both lives completely out of kilter.

That's where the American Cancer Society (ACS), an associate member of United Way, came to the rescue. "Several volunteers used their own cars to drive him to St. Joe's for therapy," she says. "The ACS reimbursed them for gas."

The surgery — on the brain area controlling movement, in the left side of his brain — had affected his right leg. He still walks with a limp. But, he didn't lose control of his arm as the doctors had feared.

His general health is getting better now. The seizures are controlled by medication — when he doesn't neglect taking it. His hair is growing back.

There's reason to hope. Life is almost back to normal, as it couldn't have been without the agency's having tided them over for that brief spell of helplessness.

Donor's Option

Two Decades of Life Made Easier

Mary Gonzales, mother of Rose Mary Gurule (7240), passed away two years ago from complications associated with muscular dystrophy.

But the 20 years she lived with the disease, a progressive wasting of the muscles, were made easier to bear with a smile thanks to the help of the Muscular Dystrophy Association (MDA). The MDA had pitched in with a full range of well-planned services through the years.

Mrs. Gonzales was about 40 years old and had eight children living at home when she was first stricken. Her husband had just died. She found herself falling for no reason. She couldn't climb the stairs. And it took a while to diagnose her ailment.

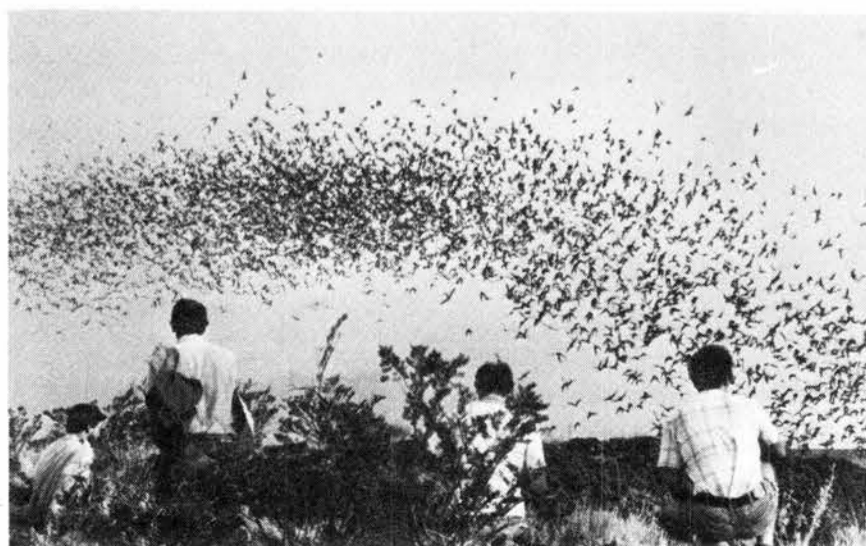
At first, walking with a cane helped. Then, over the years she had recurrent bouts of pneumonia, which further weakened her. She broke her leg. MDA came through with a walker, later with a wheelchair. Staffers analyzed the layout of her Santa Fe home, and installed railings in strategic locations throughout the house to give her more mobility.

For five years, Mrs. Gonzales had a hospital bed at home to make her more comfortable. And all she had to do was pick up the phone and call the MDA consultants: They would make home visits and provide therapy or bring items — i.e., an oxygen tank — that helped meet her physical needs.

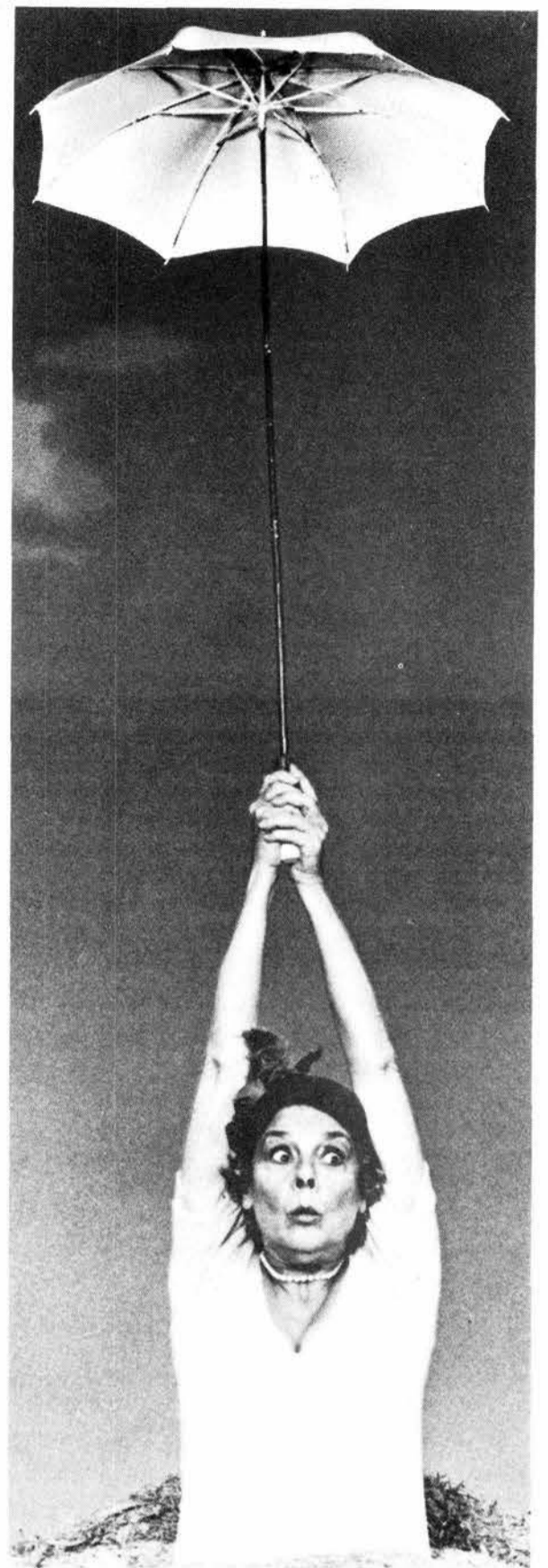
Mrs. Gonzales had a limited income: Social

Security and veteran's benefits. Later she qualified for Medicare, which took care of the major part of her hospital costs. MDA picked up the bills for physical therapy and medication.

"All around, MDA helped us all as we grew up because it made her life easier and more comfortable," says Rose Mary. "Now I would like to give back a little to MDA because through the years it gave my Mom so much support."



ON GUARD, CHIROPTEROPHOBICS! The Nature Conservancy organized a field trip last fall to a 360-acre site in southcentral N.M. that harbors the state's largest breeding colony of Mexican free-tail bats. The Conservancy is a non-profit group — an approved candidate for Donor Option contributions — that tries to acquire private land of highest ecological value and then turn it over to federal agencies such as BLM or the Forest Service. (Photo by Nolan Hester.)



CLINGING TO HER PARASOL, at once her sunshade and her symbol of deliverance, Irene Worth stars in the Great Performances production of Samuel Beckett's "Happy Days" on PBS. KNME-TV offers a variety of programs on Channel 5, and can be listed as a Donor Option in Sandia's ECP campaign in October.

MDA is not a United Way agency. However, Sandia's Employee Contribution Plan (ECP) provides a Donor's Option for targeting your donation. The choice can be either a United Way agency or any other (approved) agency that provides humanitarian aid.

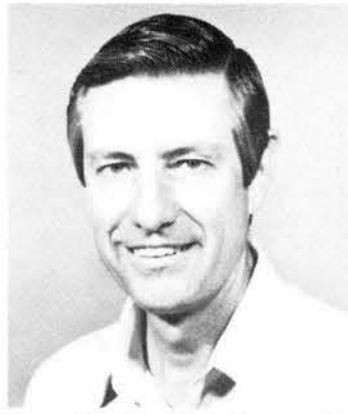
MILEPOSTS

LAB NEWS

AUGUST 1986



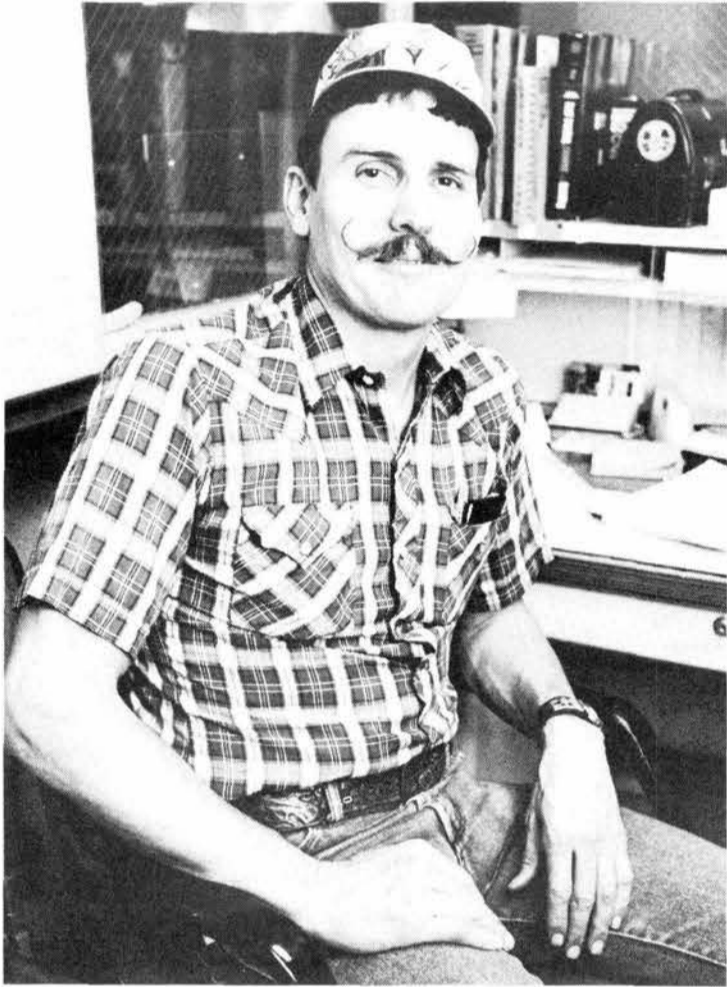
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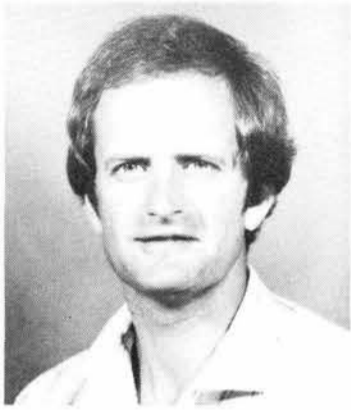
Marv Bauder (7524) 30



Jose Llamas (7556) 30



Keith Mote (7482) 20



Charles Jakowatz (315) 10



Jim Pergrossi (8184) 20



Walt Ghio (8431) 20



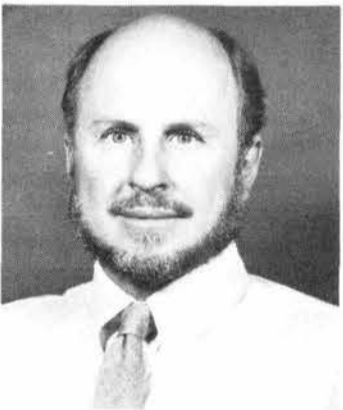
Arline Harrell (8400) 10



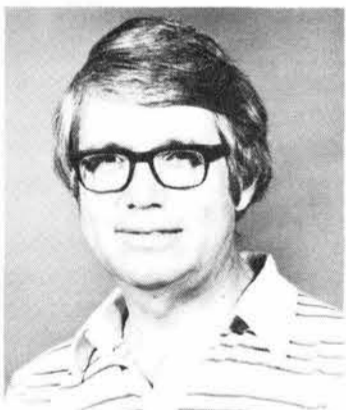
Chuck Martinez (7112) 10



Bill Moore (1253) 10



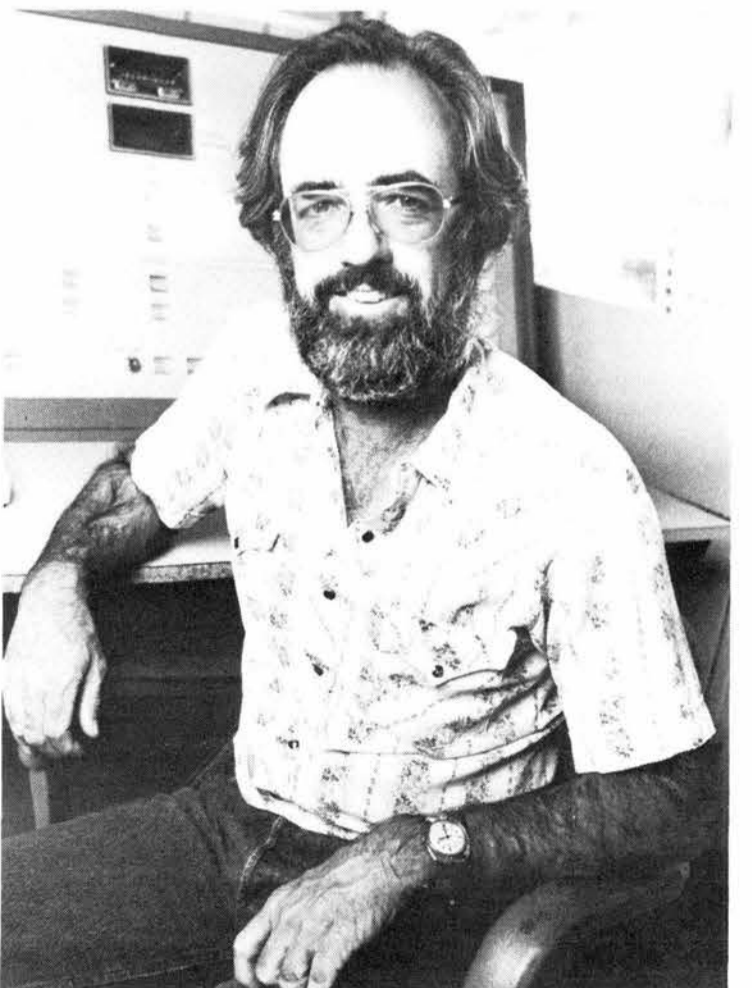
Bob Anderson (1815) 15



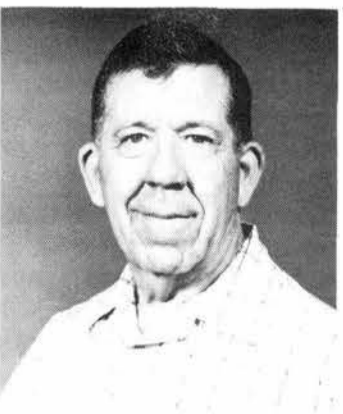
Warren Brown (314) 15



Olivia Harris (4021) 10



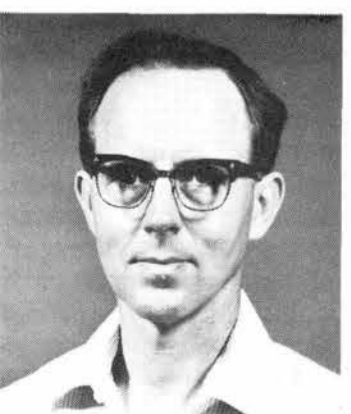
Ken Campbell (7541) 20



Chuck Stanton (2123) 30



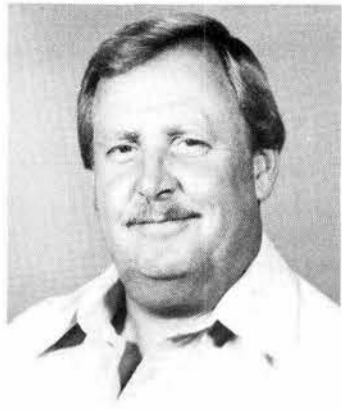
Marrian Salomon (2124) 35



Lowell Jones (311) 20



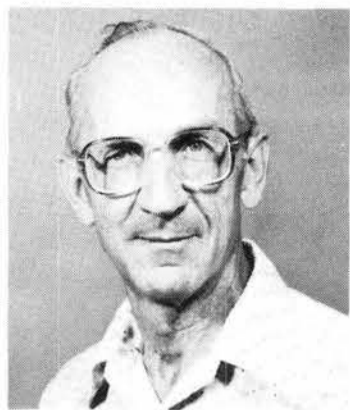
Gladys Rowe (3144) 20



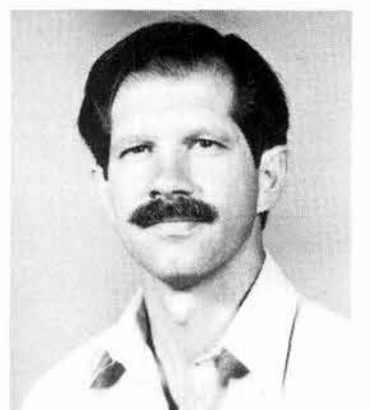
Sam Bolin (5238) 20



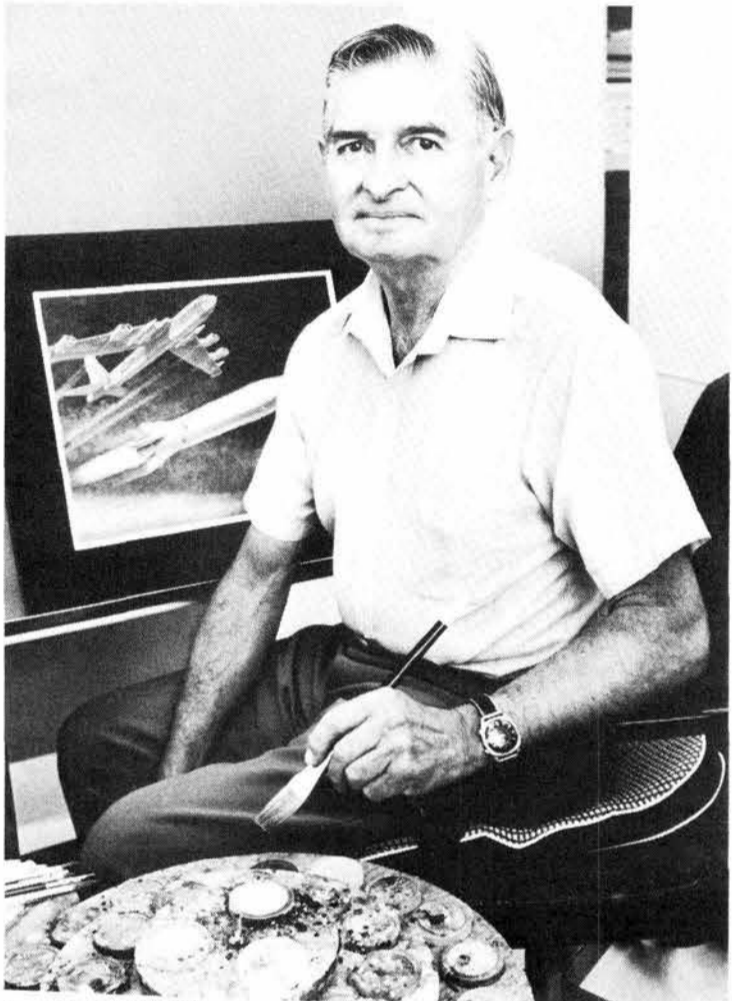
Ray Reynolds (5170) 25



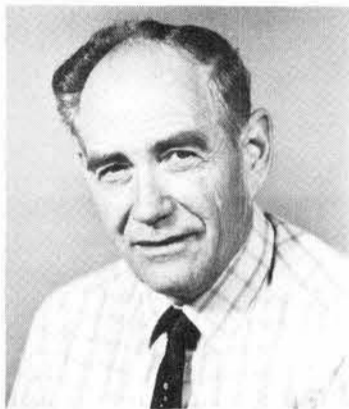
Paul Bailey (1642) 25



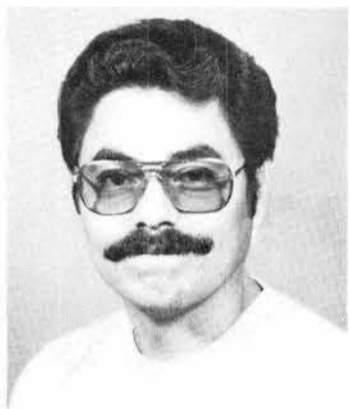
Sid Domingues (6451) 10



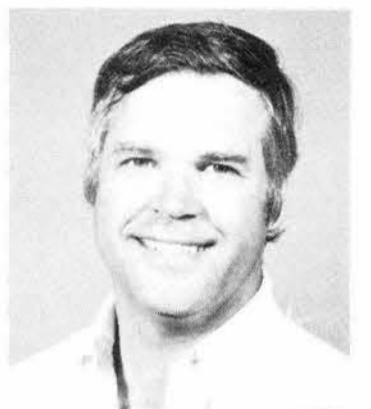
Leo Ortiz (3155) 40



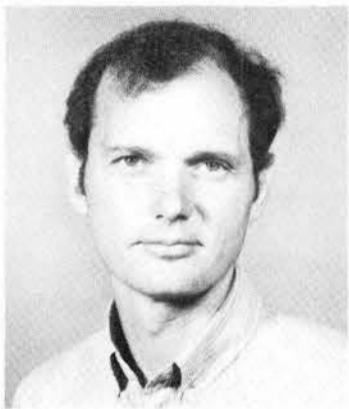
Leland Allen (5113) 30



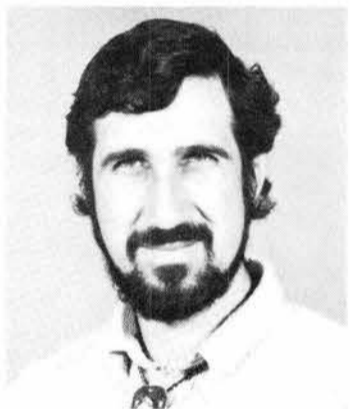
Mel Gonzales (7474) 10



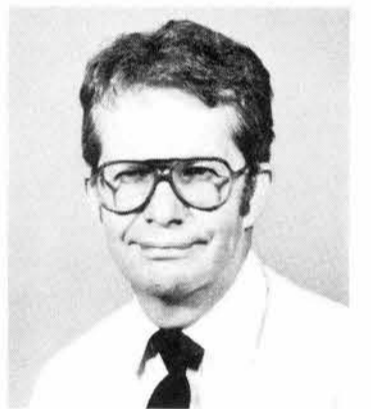
Mike Thomas (6223) 10



Bill Wampler (1112) 10



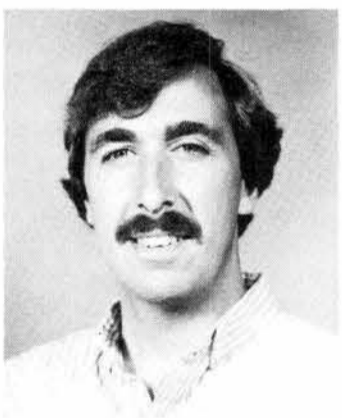
Barry Schwartz (6313) 10



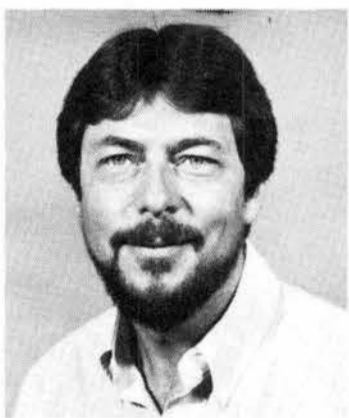
Dick Shepardson (155) 20



Joe Muench (7222) 40



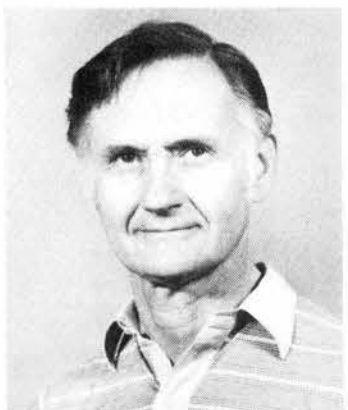
Dave Hannum (1542) 10



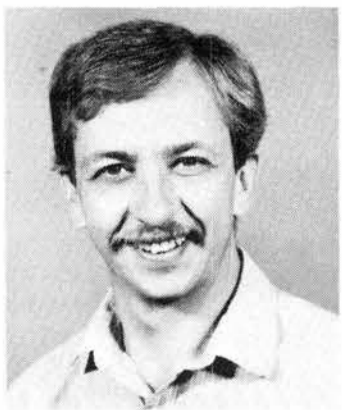
John Strascina (7476) 20



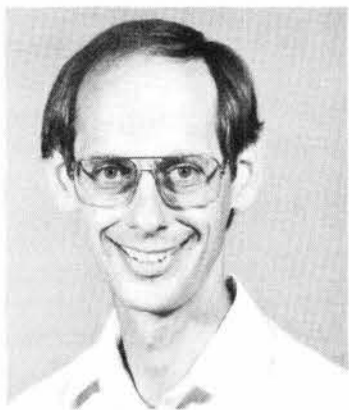
Herb Pitts (3100) 25



Vernon Duke (7862) 20



Paul Hommert (6258) 10



Tom Hinkebein (6314) 10

Events Calendar

Aug. 29-Sept. 30 — Exhibit, Ye'ii, Ye'ii Bichai and Navajo dry painting ceremonial tapestries; 9 a.m.-4 p.m. Mon.-Fri., 10 a.m.-4 p.m. Sat.; Maxwell Museum of Anthropology, 277-4404.

Aug. 29-Sept. 22 — "Mother Courage and Her Children" by Bertold Brecht (translated by Ralph Manheim), 8 p.m. Fri.-Sun., Vortex Theatre (Buena Vista & Central), 247-8600.

Aug. 29-Sept. 26 — New Mexico Glass Show VI, UNM Student Union Bldg., 242-5582 or 842-5541.

Aug. 29-Sept. 1 — Tenth Anniversary Celebration: Indian dances, fashion show, arts & crafts show,

crafts demonstrations, entertainment; 12-5 p.m.; Indian Pueblo Cultural Center, 843-7270.

Aug. 30-31 — Feria Artesana: Southwestern Hispanic arts & crafts celebration, 10 a.m.-8 p.m., Convention Center and Civic Plaza, 768-4575.

Sept. 2 — Feast Day of St. Stephen, corn dances, Acoma Pueblo, 552-6606.

Sept. 4 — Feast Day of St. Augustine, harvest dance, Isleta Pueblo, 869-3111.

Sept. 5-21 — New Mexico State Fair, NM State Fairgrounds.

Sept. 7 — Second City Touring Company, 8 p.m.,

KiMo Theatre, 848-1374.

Sept. 8 — Nativity of Mary Feast Day, harvest and social dances, Laguna Pueblo, 552-6654.

Sept. 9-20 — All-Star Rodeo, NM State Fairgrounds.

Fun & Games

Soccer — A meeting of all those interested in the sport will kick off the fall season for the Sandia Soccer Assn. The meeting is on Sept. 11 at 5 p.m. in Rm. B-4 of the Coronado Club. (SSA officers: Be there.) More info from Erin Hallenborg (ITRI) on 4-8807.

CLASSIFIED AD

CLASSIFIED AD

CLASSIFIED AD

CLASSIFIED AD

Deadline: Friday noon before week of publication unless changed by holiday. Mail to Div. 3162.

Ad Rules

1. Limit 20 words, including last name and home phone.
2. Include organization and full name with each ad submission.
3. Submit each ad in writing. No phone-ins.
4. Use 8 1/2 by 11-inch paper.
5. Use separate sheet for each ad category.
6. Type or print ads legibly; use only accepted abbreviations.
7. One ad per category per issue.
8. No more than two insertions of same ad.
9. No "For Rent" ads except for employees on temporary assignment.
10. No commercial ads.
11. For active and retired Sandians and DOE employees.
12. Housing listed for sale is available for occupancy without regard to race, creed, color, or national origin.

MISCELLANEOUS

SWIM FINS, scuba- or snorkeling-type, used once, one large and one medium pair, \$26 new, sell for \$15/pair. Montoya, 296-4268.

12-STRING GUITAR, \$175, will consider trade. Trujillo, 865-5438.

BABY CRIB w/mattress, \$45; 2 high chairs, \$20 ea.; playpen, \$15; infant seat, \$8; car seat, \$15. Davis, 298-5868.

PANELING, 4' x 8', simulated pecan wood on 1/8" Masonite, 17 sheets, \$70. Perdreauville, 296-2870.

BUMPER JACK, automobile, extra heavy-duty, ratchet-type, dual-mode chain link bumper hook, \$15. Schkade, 292-5126.

SEARS 2000-W GENERATOR, \$700 new, asking \$350. Douglas, 281-9843.

FENCING MATERIAL: chain link, 4' high, 30¢/ft.; large, sturdy work table, 6' x 4' w/welded barstock legs and formica top. Blacker, 298-0096.

SILVA CROSS-COUNTRY SKIS, Nordic shoes and poles, assorted sizes, \$75/set; 3 pair Sherpa snow shoes. Reuter, 884-8347.

TWO CHEV. RIMS, 15", 5-hole, \$15; misc. camper windows, make offer. Marquez, 344-8455.

3/4-SIZE VIOLIN, w/bow and case, \$245. Kupferman, 265-7224.

CAMPER SHELL, for small pickup with long bed, insulated and paneled, \$350 OBO. Hackard, 299-4333.

GAS DRYER, General Electric, heavy-duty, \$95. DeReu, 275-2336.

DINNERWARE, Mikasa Opus, black, 8 five-piece place settings plus completer, originally \$375, will sell for \$275 OBO. Hale, 298-1545.

BROILER OVEN, sunlamp, salon-style hair dryer, diaper pail, stroller, Sears 165R13 tires. Phipps, 299-8490.

TRUMPET, Bundy, \$175. Cook, 296-3064.

TOOL CHESTS: machinist, mechanic, homeowner types; also roll cabinets and craftsman workbenches. Norris, 296-6679.

4-WAY SOFT TOP for '78-'82 CJ5 Jeep, Besttop, black, all hardware and instructions included. Sanchez, 873-1271.

DARK WALNUT CRIB, w/mattress and matching changing table, rocking

chair; Gerry Bear 3 baby swing, no winding required. Vaughan, 293-3103.

JAPANESE ANTIQUES: Tansu, water and sake jugs, abacus. Davis, 293-7457.

KITCHEN TABLE w/6 chairs, \$35. Maestas, 831-4072 after 5.

VELVET COUCH and matching chair, zippered cushions, pale green, \$200; Deluxe portable Morse sewing machine, attachments and manual, \$80. Sanchez, 298-4803.

THOMPSON CENTER, 45-cal. Seneca, \$170; Manufacture 12-ga., over & under, skeet 1 & 2, vent rib, single selective trigger, selective ejectors, \$350. Klett, 884-8354.

STEAMER TRUNK, for dormitory storage, \$8; sturdy, wood, 30" x 48" work table, \$8; antique chair, \$5; all prices OBO. Cole, 298-1464.

RIFLE, muzzle-loading, .54-cal. Diegle, 294-5565.

HALF-SIZE VIOLIN, suitable for beginning student. Leisher, 281-5258.

ELECTRIC TYPEWRITER, Smith-Corona Enterprise, cartridge ribbon, \$35; Realistic STA-14 stereo receiver w/2 speakers, \$35. Almquist, 294-4723.

COMMODORE PLUS FOUR COMPUTER, built-in word processing, spreadsheet, file management, graphics, and machine-language software packages, still boxed. Shorten-carrier, 292-3575.

KITCHEN DINETTE SET, traditional wood, rectangular, 4 chairs, upholstered seats, \$150. Martin, 822-8260.

CAB-OVER CAMPER, '78 Pony Coach, for small long-bed pickup, refrigerator, stove, oven, running water, Porta-Potti, \$1600. Kepler, 296-0402.

MATTRESS SET, king-size; wood window shutters; steel utility shelves; Topcon 35mm camera, inoperative, for parts only. Schowers, 822-8494.

HERCULON SOFA and love seat; 130 lb. of weights, bench and bar for teen boy. Steover, 296-3717.

INFANT'S SWING, \$8; box fan, \$5; lounge chairs, \$3; cartop luggage carrier, \$20. Webb, 294-8341.

SNOW TIRES, mounted, Chev. Impala rims, \$35/pr.; two P215 radials, \$10 ea.; shotgun reloading equipment and supplies. Connor, 268-9497.

PANASONIC RACER, woman's 26", 10-spd., \$75; Smith-Corona manual portable typewriter, German math keys, \$100. Frix, 294-5268.

BEDS: box-frame twin, oak headboard, mattress, \$80; loveseat, hide-a-bed, wide single, brown plaid earthtones, \$120. Holmes, 292-0898.

FOUR WHEELS, fit Courier pickup, includes tires (some miles left), hubcaps, and lugnuts, \$80 OBO. Curtis, 881-2440.

POOL TABLE, 4' x 8', ball return, built-in levelers, balls, cues, cue wall rack, not slate, you move, \$125. Martin, 821-0037.

TYPEWRITER, Olivetti, electric, elite, \$80; Hoover upright vacuum, \$30; mirror tiles, 50¢ ea.; standard dumbbell handles, \$8/pr.; dumbbells, \$15/set. Ferrell, 883-8812.

CARPET with pad, avocado, 40 sq. yds., \$100. Barham, 298-7304.

PICKUP CAMPER SHELL, 65" x 76" x 28", paneled, screened windows, \$150 OBO; double-size metal bed frame, \$10. Berman, 296-5640.

PROJECTORS: Sawyer's Rotomatic slide projector w/carousel, \$25 OBO; lantern slide projector, \$20 OBO. Stephens, 821-7960.

VW DUNE BUGGY BODY, fiberglass, extra parts, \$1400 or trade for small

sailboat of equal value. Edmund, 881-7974.

ALUMINUM STORM DOORS: white, two are 32", one is 36", \$75 for all. Puhara, 255-7447.

FOOD SLICER, Eival electric, \$35; TE toaster oven, \$15; cassette tape recorder, new, built-in microphone, best offer. Hoff, 294-4835.

REFRIGERATOR, harvest gold, \$200. Williams, 268-9757.

JAYCO FOLD-DOWN TRAILER, 1985, heater, wardrobe, overhead cabinets, slide-out stove, awning, extras. Wenger, 822-1487.

VIOLIN, Roth, \$250. Morosin, 298-0994.

BABY WALKER, circular, tip-resistant, \$8; matching couch and chair, seldom used, \$160; 650-W microwave, \$175. Vigil, 821-8059.

WOOL SWEATERS, Portuguese, handmade, men's and women's sizes, cardigans and pullovers. Brown, 821-7553.

ELECTRIC TYPEWRITER, \$75; sofa sleeper, \$65; oak pedestal table and 4 captain's chairs, \$375. Eley, 242-8530.

ANTIQUÉ SIDEBOARD, 1920s bedroom set, scythe, wagon wheel, old lamps, antique European chair. Tomek, 299-0471 leave message.

CARPET PAD: 125 sq. yds., multi-light browns; 45 sq. yds. multi-rust and golds; 4 hall lights w/glass hurricane shades. Connor, 293-7608 or 268-8718.

FREEZER, Admiral Energy Saver, 18 cu. ft., 4 yrs. old, \$300; 6' sliding glass door. Shrouf, 821-0765.

BUNK BEDS w/mattresses, \$85; student desk, \$30; boy's 4-drawer dresser, \$35; semi-electric typewriter, \$50. Sallee, 296-9116.

GUITAR, D-41 Martin w/hard case, left-handed, \$1400. Perryman, 281-3020.

COUCH & LOVESEAT, Broyhill contemporary, cream-colored, \$300 OBO; coffee & end tables, wood w/glass, best offer. Wilson, 821-5442.

DINETTE SET, table and 4 chairs, \$35. Miyoshi, 821-9118.

TRUMPET, Bundy, used one year, \$150. Knapp, 294-6359.

SOFA, Broyhill traditional, off-white, 90", tufted back, reversible seat cushions, skirted base, provide own transportation, \$250. Ratzel, 298-7167.

12 KITCHEN CABINETS, \$800; French door, \$45; Zenith 21" color TV, \$35; BBS wheels and tires for BMW. Carson, 281-5115.

TRANSPORTATION

'77 DATSUN PICKUP, new V-6 engine and AT, 5 new radials, \$1800. Davis, 298-5868.

'79 F-150 FORD PICKUP, 350M V-8, 4-wheel drive, 4-spd., LWB heavy-duty bumper. Houghton, 299-3386.

'83 TOYOTA SUPRA, 3-dr., all options including power sunroof, 5-spd., sport pkg., \$9850 firm. Collins, 266-5868.

'83 TOYOTA PICKUP, AC, AM/FM radio, AT, below book, \$4500. Marquez, 873-1127.

'57 CHEV., 4-dr., wagon, 6-cyl., new interior, \$1999. Pierce, 299-2801.

'52 DODGE CLUB COUPE, 6-cyl., \$1200. Woods, 892-9029.

'81 SUZUKI GS450T, 10K miles, garaged, records, extras, new tires, chain, and battery, \$1000 firm. Hueter, 299-7263.

'85 PONTIAC GRAND AM, red, 2-dr. coupe, 28K miles, 5-spd. Potts, 821-1013.

'84 HOLIDAY RAMBLER MOTOR-HOME, loaded, will consider low-mileage mid-size car trade. Clement, 299-2324.

'74 HONDA ELSINORE 125cc dirt bike, \$250. Davis, 293-7457.

'81 HONDA CB750 custom motorcycle, Honda fairing, Vetter tail trunk and saddlebags, 21K miles, recent overhaul, guaranteed, \$1500. Brandon, 836-5621.

'72 LINCOLN CONTINENTAL MARK IV, white over red leather, 72K miles; 18 ft. boat, fiberglass over wood, needs work, no trailer or motor, \$350. Kerschion, 281-1671.

'54 FORD CUSTOMLINER, 6-cyl., 3-spd., new tires, paint, and upholstery, quiet mechanicals. Schaub, 821-7242 after 5 and weekends.

'82 BLAZER, 4-wheel drive, 5L V-8 gasoline, AT overdrive, Silverado, PS, PB, AC, cruise, AM/FM cassette, 55K miles, \$8400. McDowell, 821-0339.

'74 CHEV. MONTE CARLO, radials, PS, PB, PW, tilt wheel, Blaupunkt AM/FM cassette stereo, \$1200. Harrison, 292-6856 evenings.

'85 KAWASAKI NINJA 600R and '85 GPZ 550, low mileage, garaged, \$2900 and \$2500 OBO. Turner, 843-7088.

'83 MAZDA GLC CUSTOM L, 3-dr. hatchback, 5-spd., AC, cruise control, AM/FM, 32K miles. Dunckel, 888-2484.

'79 ALPHA ROMEO SPIDER convertible, 5-spd., 45K miles, \$6400. Gomez, 291-9322.

'80 MERCURY, new paint and tires, transmission overhauled, \$2300 OBO. Romero, 299-5604.

'86 NISSAN PICKUP, red with gold accent stripe, 5-spd., low mileage, factory warranty, \$5700 OBO. Scheibner, 268-0344 after 5.

'79 DATSUN 210 WAGON, AC, FM radio, low mileage, new shocks, below book, \$1500. Frix, 294-5268.

'82 PONTIAC FIREBIRD, AT, AC, PS, PB, AM/FM cassette, tilt wheel, cruise control, \$4900. Nickerson, 299-3101.

'85 TOYOTA PICKUP, AC, AM/FM cassette, bed liner, low mileage, \$5900 OBO. Gagliano, 266-3027.

'76 CHEV. MINI-MOTORHOME, 23', cruise control, tilt wheel, dual tanks, new upholstery and tires, rebuilt springs, more, \$11,750. McConahy, 884-5071.

'79 KAWASAKI 750, low mileage, \$900. Roma, 298-6365.

'80 YAMAHA 650 SPECIAL, 7K miles, garaged, \$850. Romero, 821-7154 after 5.

'81 SUZUKI MOTORCYCLE, GS850G, shaft drive, 8K miles, Vetter fairing, 2 helmets, \$1100 OBO. Chavez, 299-5102 or 292-5475.

'71 CORVETTE, rebuilt original 454, new interior, nearly complete restoration, needs paint, \$8500. White, 293-2219.

'72 VW BUS, 50K miles, auto-reverse tape with Dolby, \$1200. Strip, 292-7490.

'78 FORD GRANADA, 2-dr., V-8, 67K miles, gray/red interior, \$1700; '76 GMC 1/2-ton truck, Sierra Classic, 454 engine, 67K miles, cream w/red vinyl top, red interior, all-weather tires, \$3300. Vigil, 821-8059.

'85 SUBARU 4-wheel drive GL wagon, FM cassette equalizer, 5-spd., high low range, AC, PB, service manuals. Ritchey, 268-7620.

'77 DATSUN 710, AC, 4-spd., AM/FM cassette, \$1500. Bertram, 293-8356.

'73 OLDS. DELTA 88, AC, stereo radio, best offer. Palmer, 821-8563.

'82 TRANS AM, black w/gold trim, new tires, 42K miles, \$7500 OBO. Wilson, 821-5442.

'80 CHEV. LUV 4X4, camper shell, AM FM cassette, \$3650 OBO. Wright, 298-0608.

'72 CHRYSLER NEWPORT, 56K miles, AT, PS, PB, \$850. Demmel, 299-5639.

'81 RELIANT STATION WAGON, AT, PS, PB, AC, 60K miles, \$3200. Miyoshi, 821-9118.

MOTORCYCLES, Yamaha RDs: '79, 400 Daytona Special, \$975; '75, 350, \$575; sailboat, Chrysler Man-O-War, 15-1/2 ft., new bottom, trailer w/spare, \$975. Lachenmeyer, 268-7475.

REAL ESTATE

3-BDR. HOME, off Rio Grande, close to downtown, 1-3/4 baths, greenhouse, sunporch, garage, and carport, 1300 sq. ft., \$59,000. Shunny, 265-1620.

3-BDR. PATIO HOME, Thomas Village, 2 kiva FPs, skylights, central vac/security system, spa off master bedroom, fruit trees, autodrip. Brigham, 843-6023.

QUARTER OWNERSHIP in furnished condo w/2 jacuzzis at Silvercreek Inn ski resort. Will consider economical mid-size car trade. Clement, 299-2324.

TEN LEVEL ACRES, 7 miles south of Moriarty, near electricity, phone, \$20K, will consider barter and terms. Smith, 384-5182.

3-BDR. HOME, Sandia HS within walking distance, den, FP in LR, many updates, energy efficient, patio w/barbeque. Pettit, 292-0789.

MOBILE HOME, 14' x 72', 2 add-ons, on large lot, large kitchen, vault ceiling, fenced yard, \$9500 OBO. Tafoya, 281-1454.

TOWNHOUSE, 1700 sq. ft., 3-bdr., 2-1/4 baths, custom-built, double garage, FP, 2-story, redwood deck. Jajola, 292-7962.

3/4-ACRE, Bosque Farms, zoned no trailer homes, terms or cash. Hamilton, 869-2718.

HOMESITE, .4 acres north of Cedar Crest, borders national forest, views of Santa Fe and Sandia Knolls valley. Sanderlin, 298-7147.

1.3 ACRES, El Pinar Estates, 14 miles east of city, off frontage road, wooded, electricity, \$8000. Perryman, 281-3020.

3/4-ACRE LOTS, Corrales, horses permitted, underground utilities, no mobile homes, zero down, \$25,000 owner financing. Tidmore, 884-1870.

2-BDR. HOUSE, 1300 sq. ft., alley access, large 2-car garage workshop, landscaping, covered patio, FP, knotty-pine den, San Mateo & Lomas. Ritchey, 268-7620.

3-BDR. HOME, on 2 acres, Cedar Crest, N14 frontage, 2 baths, great room, detached guest house and garage. Carson, 281-5115.

5-BDR. HOME, near base, formal dining room, 32' den, mature green. Stromberg, 255-6131.

WANTED

FIREWOOD, in exchange for cutting down uncomplicated trees (leave small branches). Shunny, 265-1620.

LOGO educational software for an IBM-compatible personal computer. Biringer, 821-8741.

BOAT, 12 ft., lightweight, aluminum, "V" bottom style. Holmes, 292-0898.

Coronado Club Activities

Last Splash Next Monday

SPEND YOUR LABOR DAY holiday (Sept. 1) at the pool closing celebration from 11 a.m.-6 p.m. It's fun for the whole family, with plenty to eat at the a la carte BBQ buffet served from 11-5, and games for folks of all ages scheduled from 12-5. Sounds Unlimited belts out the dancing music from 1-4. And, of course, swim to your heart's content all day long. Summer may be drawing to a close, but at least this big party helps things wind down in style. Members get in free for the last-splash bash; admission for guests is \$1.

IT'S HOEDOWN TIME next Friday night, Sept. 5, with the Isleta Poor Boys presenting country-western shuffle music from 8:30 p.m.-12:30 a.m. To get your shufflin' shoes ready to go, take advantage of the c-w dance lessons from 7:30-8:30 that night. Prime rib or poached halibut are featured on the two-for-one dinner special beforehand — your choice of two dinners for the low price of \$14.95. Other entrees are available at the same special price. Do yourself and the Club kitchen a good turn by calling in your dinner reservation at 265-6791.

FAMILY/VARIETY NIGHT on Saturday night, Sept. 6, starts out with a low-cost buffet from 5-6 p.m. that features culinary delights — pizza, hot dogs, hamburgers, etc. — for every member of the family. Featured on the big screen at 6 is "Treasure Island," starring Long John Silver. You might say afterward that you've been pirated away for the evening!

CROWDS POUR IN every time for the C-Club's Sunday brunch, and there's a very good reason: It's the best brunch deal in town! The next one's scheduled for Sept. 7 from 11 a.m.-2 p.m. For only \$4.95, you have your choice of ham, sausage, baron of beef, scrambled eggs, hash browns, green chile, fruit salad, salad bar, and more. Kids under 12 eat for half price. (What did we say about a *deal*?) Here's your chance to relax on Sunday and let the Club staff worry about the dishes. But don't let 'em worry about how to stock the pantry; be sure to call the C-Club office for reservations at 265-6791.

VOTE, DEFINITELY — And win a door prize, maybe. It may not be the most exciting Club function of the year, but it's the most important. It's the Annual Meeting, after work on Monday, Sept. 8. Come out and vote your choices for C-Club board members anytime between 4 and 6. The slate includes Chuck Duus (132), Mark Kiefer (1265), Alice Maese (121), Tom Mehlhorn (1265), Michael O'Bryant (2858), John Otts (6222), Mike Robertson (3533), Marlene Smith (2857), and Ken Sorenson (6322); stop in at the Club lobby next week and check the photo to match those names to faces. (More nominations will, of course, be accepted from the floor during the meeting.) Those voting are eligible for some special door prizes. The meeting, which starts at 5, will also give you a chance to voice your comments, criticisms, and congratulations to the board members. Afterward, free beer and munchies are yours for the asking.

OUR FAVORITE CARDSHARKS are back at their old tricks, come Sept. 8! Thunderbird card players meet — after a long summer hiatus — that day from 10:30 a.m.-3:30 p.m. in the C-Club ballroom. Not only is there all kinds of gaming available; you can also catch up on what's been happening to all those mean dealers for the last three months.

THE CLUB GOES LATIN two weeks from tonight, Sept. 12, with south-of-the-border dancing music from 8:30-12:30 by Spinning Wheel. To get you in a cha-cha mood, Miguel Caro and the Mexican Fiesta Dancers will perform from 7:30-8:30. The evening's complete if you reserve your space at the two-for-one dinner special; headlined that night are



filet mignon and lobster tail, though other entrees are available as well.

BARREL-STAVE SKIERS, take note! Here's a chance to find out what else is out there in the way of ski equipment. The Coronado Ski Club's annual Ski Fair is set for Tuesday, Sept. 16, starting at 5 p.m. at the C-Club patio. All sorts of items will be on display, including the latest in ski equipment, as well as attire for the well-dressed schussboomer. You'll also see exhibits featuring ski and resort areas of the region. Everyone's welcome to the Fair, but only Ski Club members are eligible to win the fabulous door prizes. (If you're not a member now, take heart — you can sign up at the Fair, and be eligible for prizes all at the same time!)

SENTIMENTAL JOURNEY? Maybe so, if you sign up for some of the C-Club trips coming up in the next few months:

Laughlin/Lake Havasu — Good news! The final payment date for this trip has been extended to Sept. 10. Stay at the posh Edgewater Casino/Hotel in Las Vegas South (aka Laughlin), and take a day trip to Lake Havasu City for London Bridge and the other LHC sites/sights. For \$150 you get RT motorcoach fare, three nights in Laughlin, a free breakfast or lunch buffet, and refreshments along the way.

Aspencade — Get on board for this bus trip, set for Sept. 27-30, to southern Colorado and northern New Mexico. You head for Telluride the first day, with lots of stops along the way to admire those tremendous fall colors. After a two-night stay in Telluride, you travel over the "Million Dollar Highway" to the old mining towns of Ouray and Silverton. Between Silverton and Pagosa Springs, picture-taking stops include Purgatory Ski Area, Honeyville Farms, and Vallecitos Reservoir. You overnight in Pagosa Springs, then it's on to the northern NM high country — Chama, Tierra Amarilla, and Taos. On the way home to Albuquerque, there's a dinner stop at Rancho de Chimayo. Included in the \$145/person tab are charter bus fare, three nights' accommodations, continental breakfasts, refreshments on the bus every day, and dinner in Chimayo. Don't miss this one — and don't forget to bring your camera!

Around South America — This brand-new travel offering will take you to the fabulous Carnival in Rio and to Buenos Aires, Cuzco, Lima, Sao Paulo, and the lost city of Machu Picchu. Twelve nights, three dinner shows, tours of all the cities plus a day

AUTHENTIC REGIONAL DANCES and costumes from the states and eras of Mexico are the specialty of Miguel Caro and the 14 members of his Mexican Fiesta Dance Company, headliners at the C-Club on Sept. 12. From left front, Diana Martinez in a Revolucion costume, Miguel Caro himself in Aztec dress, and Paula McGuinness representing Vera Cruz. In rear, Annittra Adler and Julia Archibeque (6220) in Aztec dress and Nada McGuinness representing Chiapas. The Aztec costumes, featuring beadwork by Miguel, are magnificent. Black-and-white photo doesn't do the costumes justice — come out and be dazzled!

trip to Machu Picchu, RT airfare, breakfasts, and more for \$2200 (dbl.). Optional at extra cost: the Samba Parade and the Baille da Cidade during the Carnival.

Cozumel — Get away from it all Nov. 11-18 on the tropical island of Cozumel. You'll stay at the posh Club Cozumel Caribe (CCC), which has just about everything paradise-seekers look for: marvelous nightly entertainment, box-office movie hits, unlimited water sports (sailing, windsurfing, snorkeling, fishing, scuba diving), day trips on a Spanish galleon along the Yucatan coast, moonlit cruises. For the Jane Fondas, there are aerobics and stay-in-shape exercise classes — a good thing, because the trip price includes three meals a day and unlimited wine, beer, and cocktails! Those who just want to relax can head for those miles of white sandy beach that encircle Cozumel. For \$745/ person, you get all of the above, plus round-trip air fare, "Junior Suite" accommodations (bedroom and separate living room) for seven nights, ground transfers, beach parties and fiestas, and taxes and tips at the CCC. Thanksgiving will be a little early this year if you sign up for this one.



LOOKING FORWARD to the Ski Fair on Sept. 16 are Janet (7522) and Leo (6311) Klamerus. Here they're shown on the slopes at Crested Butte during a Ski Club-sponsored trip last year.